Doc Ref. **AK2**
Appl. No. 09/547,791

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **G06F 17/60**	A1	**(11) International Publication Number:**	**WO 98/22899**
		(43) International Publication Date:	28 May 1998 (28.05.98)

(21) International Application Number: PCT/US97/21363

(22) International Filing Date: 17 November 1997 (17.11.97)

(30) Priority Data:
60/031,059 18 November 1996 (18.11.96) US

(71)(72) Applicant and Inventor: DODSON, David, A. [US/-]; 16 Somers Gardens, 7 Green Bay Road, Hamilton FL 04 (BM).

(74) Agents: WOODBRIDGE, Richard, C. et al.; Woodbridge & Associates, P.C., P.O. Box 592, Princeton, NJ 08542-0592 (US).

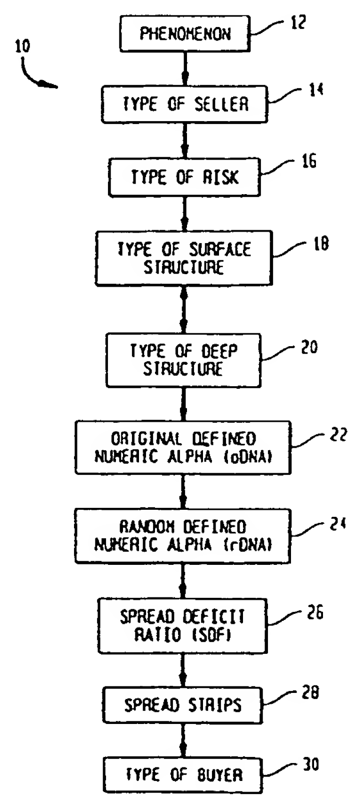
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: SYSTEM AND METHOD FOR BUNDLING RISK-PROTECTION PRODUCTS

(57) Abstract

The invention converts highly dense risk populations (16) within insurance and financial markets into separate and distinct bundles of marketable products referred to as Spread Strips (28). The bundles (28) consist of one or more strands of risks having the following characteristics: a minimum distance requirement; linear or non-linear in nature; the distribution of the bundle matching the seller's original density load; and the distribution of the bundle's liability on a ground-up basis. The method includes the steps of characterizing the type of seller and the type of risk, generating a surface structure having deep structure attributes, producing an original Defined Numeric Alpha (oDNA) (22), generating therefrom a random Defined Numeric Alpha (rDNA) (24), producing a spread deficit ratio (SDF) (26) therefrom, and finally producing a Spread Strip bundle (28) which is correlated with an appropriate type of purchaser (30).



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SYSTEM AND METHOD FOR BUNDLING RISK-PROTECTION PRODUCTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention generally comprises a computer system and method for converting highly dense risk populations within insurance and financial markets into separate and distinct bundles of spread of risk products.

2. Background of the Invention

Presently, insurance and financial markets hedge their catastrophic exposure through products that use macro or top down approaches... a cursory approach to managing risk spread and without regard to public policy. This method does not generate spread of risk. This lack of risk spread creates a random attachment point between the retention and the excess limit. The lack of risk spread generates exceptionally high confidence intervals (standard deviation) of 90% (plus) which are utilized for predicting the expected loss size of a catastrophic event. In addition, the availability of coverage and cost to the consumer can become a critical public policy issue. For example, an insurance company buys catastrophe excess coverage for the peril of hurricane. The structure might be as follows:

Excess Catastrophe Limit	$100,000,000
Insurance Company's Retention	$ 50,000,000

The excess catastrophe program does not generate spread of risk or provide any guarantee that the insurance company's excess limit is adequate or even that excess catastrophe costs will remain stable, or future catastrophe capacity will be available, or primary rates for the consumer will remain stable, or catastrophic coverage for the consumer, in the event of a major loss. For example, if the catastrophe loss is significantly right of the expected mean loss, the coverage and

the capital of the seller could easily be exceeded. This is the negative side of the upper standard deviation from the mean of distribution of sample means via stochastic modeling. This method provides little comfort to the consumer or shareholder, since it does not truly measure the state of criticality that is embedded in a highly dense risk portfolio. Also, the property catastrophe excess or other similar hedge products are not designed to provide capital, ground-up capacity, pricing stability or stable earning patterns. The lack of consideration regarding these variables can exacerbate public policy issues concerning the availability of catastrophe coverage and stable costs to the consumer in such states as California for earthquake and Florida for hurricane.

In summary, the current prior art catastrophe excess method can be segregated into the following components:

1. Indistinguishable risk populations;
2. Significant vertical risk shapes;
3. Significant commitment of capital;
4. Correlated product;
5. 3 and 5 digit zip code modeling; and,
6. Non-public policy oriented.

The prior art patent literature discloses a number of computer systems and methods for implementing and funding insurance plans to protect against future loss. A typical system is described in U.S. Patent 5,202,827 entitled "APPARATUS FOR ENSURING FUTURES CONTRACTS AGAINST CATASTROPHIC LOSS" issued on April 13, 1993 to Michael S. Sober. That patent describes a system including a plurality of point-of-sale stations which accept data from a customer and which determines when the price of the futures contract has declined below the insurance activation price.

The following patents, all assigned to College Savings Bank, Princeton, New Jersey, describe systems and methods for funding future liability against uncertain costs: 4,722,055; 4,752,877; and, 4,839,804. The funding of the future liability, namely the payment of college tuition, is by means of an insurance investment program. The computerized system estimates the expected costs of the

liability when the liability is expected to occur and computes the present value of each unit of insurance needed to yield that expected cost at maturity. The system aids the insurance fund manager in making decisions regarding investment of fund assets in order to meet present and future obligations of the fund.

The following patents also describe computer systems and methods for administering or funding insurance programs to protect against future loss: 4,831,526; 4,837,693; 5,655,089; 5,636,117; and 5,479,344.

In addition to insurance loss, there are other financial product computer systems and methods to protect against future liabilities. Note, for example, U.S. Patent 4,774,663 entitled "SECURITIES BROKERAGE-CASH MANAGEMENT SYSTEM WITH SHORT TERM INVESTMENT PROCEEDS ALLOTTED AMONG MULTIPLE COUNTS" issued on September 27, 1988 and assigned to Merrill, Lynch, Pierce, Fenner & Smith, Inc., New York, New York.

Insofar as understood, none of the prior art patents or literature describes a system that adequately protects an insurer or reinsurer against catastrophic loss. It was in the context of the foregoing prior art that the present invention arose.

Summary of the Invention

Briefly described, the invention comprises a computer system and method for converting highly dense risk populations within insurance and financial markets into separate and distinct bundles of products referred to herein as Spread Strips, for short.

Spread Strips bundles differ from the six previously described components of the prior art catastrophe excess method in the following ways:

1. They have distinguishable risk populations;
2. They have significant horizontal shapes;
3. They have an insignificant need for capital;
4. They are a non-correlated product;
5. 3, 5 and 9 digit zip code modeling; and,
6. They are public policy oriented.

Spread Strips bundles consist of one or more strands of risk with the following characteristics:

A. A minimum distance requirement D_{min} derived from the 9-digit zip code and latitude and longitude between each and every risk;

B. Linear (e.g., tornado and hailstorm), non-linear (e.g., hurricane) or vortex character (e.g., earthquake) depending upon the phenomenon involved;

C. The distribution of the bundle matches the seller's original distribution shape;

D. The distribution of the bundle will not match the seller's original density load.

The computer system and method operates according to the following steps:

First, the risk phenomenon is evaluated regarding its impact on public policy concerning the stability of the products, costs, availability of the product and the expected value of the product to the consumer. Also, consideration is given to the cost of capital and the responsiveness of the seller to provide continual coverage to the consumer for the risk related to the natural (e.g., earthquake or hurricane) or man-made (e.g., bond or stock market crash, environmental pollution) phenomenon selected;

Second, the type of seller (e.g., insurance company) is identified and the selected phenomenon (e.g., hurricane) is linked to the seller of the catastrophic event;

Third, the type of risk selection (e.g., insurance policy) is linked to the type of phenomenon and seller;

Fourth, a surface structure topology is selected (e.g., a combination of geographical, climatology and sea-surface temperatures) and is linked to the type of phenomenon; seller and risk;

Fifth, a deep structure (e.g., attributes applicable to an insurance policy) is generated by the seller's risk type;

Sixth, an original Defined Numeric Alpha (oDNA) is the seller's original database that generates the surface structure attributes;

Seventh, a random Defined Numeric Alpha (rDNA) is generated from the random and recursive permutation of the oDNA;

Eighth, a Spread Deficit Ratio (SDR) is generated including a series of ratios that identify and define horizontal and vertical risk distribution(s) derived from the rDNA;

Ninth, an accepted number of sanitized string(s) is generated for the Spread Strip bundle; and,

Tenth, a Spread Strip bundle is generated and matched with an appropriate type of buyer.

These and other features of the present invention will be more fully understood by reference to the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a hierarchial chart illustrating the steps in the method for generating Spread Strip bundles, according to the preferred embodiment of the invention.

Fig. 2 illustrates the step of selecting natural or man-made catastrophic phenomenon.

Fig. 3 illustrates the step of linking the selected phenomenon to the type of seller of the catastrophic event coverage.

Fig. 4 illustrates the step of linking the type of risk selection to the type of products of the seller.

Fig. 5 illustrates the step of linking surface structure selection to selected types of risk.

Fig. 6 illustrates the step of generating an original Defined Numeric Alpha (oDNA) from the seller's portfolio and where the surface structure selection and the risk type generate the deep structure attributes.

Fig. 7 illustrates the step of generating random Defined Numeric Alphas (rDNA) from selected oDNAs.

Fig. 8 illustrates the step of generating an acceptance string to produce Spread Strip bundles.

Fig. 9 illustrates the step of generating Spread Strips and matching same to the characteristics of the buyer in the market.

Fig. 10 illustrates a typical oDNA surface and deep structure attributes which identifies, defines and generates the outcomes applicable to the catastrophic phenomenon impacting the seller's type of risk.

Fig. 11 illustrates a singular oDNA frame or pixel defining the risk density through vertical and horizontal shapes generated from defined zip code boundaries.

Fig. 12 illustrates the original universe, i.e, oDNA, of data records for seller in the State of Florida.

Fig. 13 illustrates a bundle of small rDNA strands derived from a permutation of oDNA's and related subsets shown in Fig. 12.

Fig. 14 illustrates a singular frame or pixel identifying the risk density through vertical and horizontal shapes.

Fig. 15 illustrates a spread deficit ratio (SDR) which sums the number of risks that overlap the same space as defined by the minimum distance requirement, which is divided by the total number of risks within a defined boundary.

Fig. 16A is a micro grid of homeowner risks and their positions relative to one another.

Fig. 16B illustrates a pair of strips that a hypothetical reinsurer A might acquire.

Fig. 16C illustrates a strip that reinsurer B might acquire.

Fig. 16D illustrates a strip that reinsurer C might acquire.

Fig. 17A illustrates a prior art catastrophe excess market database comprised of indistinguishable risk populations.

Fig. 17B illustrates a kernel K17 or zip+4 having a significant vertical shape.

Fig. 17C illustrates the same kernel K17 or zip+4 having a retention of $2.5 million.

Fig. 17D is a graph which illustrates and simplifies the relationship between significant vertical shapes and confidence intervals.

Fig. 17E illustrates kernel K17 or zip+4, again, where the retention might be set at $1.25 for the cedent and wherein the reinsurer's retention would become the excess limit of $1.25.

Fig. 17F illustrates the path of a hurricane XYZ through a string of kernels K17, K24, K30, etc., and wherein the summation of the kernels applicable to the criteria of the catastrophic phenomenon sets the probable maximum loss.

Fig. 18A illustrates a kernel K17 or zip+4 according to the Spread Strips computer system and method in which the kernel has a distinguishable risk population.

Fig. 18B illustrates how nodes are distributed across the various kernels K17, K24, K30, etc., according to the Spread Strip computer system and method.

Fig. 18C illustrates how the summation of spatial attributes equals vertical retention according to the preferred Spread Strips computer system and method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

During the course of this description like numbers will be used to identify like elements and steps described by the figures that illustrate the Spread Strips computer system and method.

In order to best understand the invention, it is useful to understand how the prior art catastrophe excess method works and then compare that to the characteristics of the Spread Strip computer system and method according to the preferred embodiment of the present invention. After that the steps taken to generate the Spread Strip risk bundles become clearer.

The catastrophe excess market's database is comprised of indistinguishable risk populations, where there is no clear distinction between one risk population and another (see Fig. 17A).

The significant vertical shapes embedded within defined zip codes are derived thorough spread deficit ratios. These vertical shapes are formed by the concentration of risks within a geographical space, such as the ratio of the policy's estimated area, divided by the defined zip code's actual area. For example, in the kernel K17 or zip+4 of Fig. 17B, there are 500 risk units times a mean of 2,000

square feet within a 2,000,000 square feet area, therefore the risk distribution shape is:

1,000,000 square feet/2,000,00 square feet

or .50 spread deficit ratio.

The significant vertical shape is shown in Fig. 17B.

The confidence interval which drives the catastrophe retention is crucial both for the cedent and the reinsurer, since the retention is derived from capital driven by the expected loss of the phenomenon. For example, if the expected loss is $2.5 million, then the retention might be set at $1.250 million for the cedent and the reinsurer's retention would become the excess limit of $1.250 million (See Fig. 17C).

The more incomplete the knowledge base or indistinguishable the population, the greater the capital commitment and potential error in estimating the expected mean loss becomes for both the cedent and the reinsurer.

The greater the density of the risk population, the greater the necessity for the catastrophe excess method to use confidence interval (not confidence level) modeling of 90% or higher. Highly concentrated areas of risks can generate observations with loss outcomes correlated to both the significant vertical shape and the event, e.g., hurricane, earthquake... The natural and commonsense approach is to increase the confidence interval with the increase of risk density within a geo-space. However, this does not excuse the large interval around the mean which indicates a significant margin of error is a very real possibility.

Therefore, the confidence interval (standard deviation not confidence level) increases in proportion to the indistinguishable population and the series of significant vertical shapes generated within a 5-digit zip code. This approach is designed to capture extreme events and not necessarily the best fit. As a result, this approach causes many issues to arise and can bring an insurer to a full stop. Is the number right? Should the insurer purchase more catastrophe excess cover? Should the insurer maintain or decrease their market share? Should the insurer increase the capital base? Should the insurer hold off on writing another product

line? Does the insurer have their risk capital ratios properly correlated to their total portfolio? And so on.

The graph of Fig. 17D simplifies the relationship between significant vertical shapes and confidence intervals.

The confidence interval which drives the catastrophe retention is crucial both for the cedent and the reinsurer, since the retention is derived from capital driven by the expected loss of the phenomenon. For example, if the expected loss is $2.5 million, then the retention might be set at $1.250 million for the cedent and the reinsurer's retention would become the excess limit of $1.250 million. See Fig. 17E.

Of course, the kernel K17 or zip+4 previously discussed, is one part of the whole, therefore the cedent's overall retention could be over $1.0 billion. The summation of the kernels or zip+4 applicable to the criteria of the catastrophic phenomenon sets the probable maximum loss. See Fig. 17F for the effect of a hurricane passing through a group of kernels K17, K24, K30, etc.

A property portfolio is correlated to capital, loss estimates and hedging via catastrophe excess. The correlation is relative to the demand and supply of the consumer and the equity of the insurer and reinsurer. Elements which fall outside the control of the cedent are as follows:

1. historical demographics and the insurance agent,
2. regulatory agencies,
3. risk load for lack of spread, and,
4. affordable reinsurance capacity.

In contrast to the foregoing, using the Spread Strip computer system and method, the cedent and the reinsurer have distinguishable populations and complete knowledge of the string of risks ceded and assumed by geo-site, policy number and type, address, A-B-C limits, zip+4 ... longitude and latitude (see Fig. 18A).

The Spread Strips method generates significantly horizontal shapes via spread of risk within each kernel or zip+4 which in turn is embedded in a 5-digit zip code which in turn is embedded in a 3-digit zip code. As a consequence, the

probability of a loss event occurring becomes less of a focal point. Instead of the event, the estimation of the damage component becomes the primary area of concern (see Fig. 18B).

The Spread Strips computer system and method generates a virtual retention for the buyer (e.g., the reinsurer), which is made-up of the collective distances between each policy within each and every defined zip code boundary. This virtual retention can be understood by referring to Fig. 18C. The virtual retention is a by-product of the Spread Strips computer system and method of the present invention. The summation of virtual retentions generates capital to the seller since Spread Strip bundles provide ground up protection.

As a result of stretching risks via significant horizontal curves across the geo-plane, the Spread Strips computer system and method is not capital intensive for the buyer (e.g., reinsurer). The spread of risk through the body of defined zip code boundaries reduces the severity of loss to the buyer of Spread Strips, hence the horizontal curve of each defined zip code challenges the parameters of the peril event.

The Spread Strips method provides a distinct non-correlated product to any other product line in the reinsurer's (buyer's) portfolio. The cedent is able to convert a non-performing asset (peril of hurricane, earthquake), non-adaptive risk into a performing asset (spread of the risk peril) as well as an adaptive method of managing the risk. Similarly, the reinsurer assumes the converted asset and derives the benefit of becoming a virtual insurance company with spread of risk.

The Spread Strips system and method generates for the insurance and/or financial markets: (a) spread of risk; (b) 100% ground-up coverage; (c) increased capital; (d) reduction of hedge costs; (e) stable earnings pattern; (f) dividend for hedge; (g) complete knowledge of risk ceded; (h) maintaining or increasing their market share; and (i) long-term confidence in the public domain.

The Spread Strips computer system and method incorporates a surface and deep structure formulation that comprises domains, sub-features and hierarchical inclinations. The outcome of the Spread Strips computer system and method is a recursive macro-micro-macro-micro spread of selected risk units.

A typical Spread Strips risk unit includes but is not limited to: insurance policies for the property, casualty and life, and financial credit cards, mortgage-back guarantees, bond and stock certificates.

The Spread Strips computer system and method modifies the rules of winners and losers in a commodity transaction in the event of a catastrophic event. A sample of catastrophic events is bond market crash, civil disorder, credit card delinquencies, earthquake, hail, hurricane, mortgage delinquencies and stock market crash. The Spread Strips rules for the players are as follows:

1. the consumer of the insurance policy, credit card, mortgage, bond or stock will have stable market relative to costs, limits and coverage;

2. the seller, the provider of the insurance policy, credit card, mortgage, bond or stock will protect their shareholders' equity and increase their risk capital base and allocation of risk capital;

3. the buyer, the provider for hedging against the potential of a catastrophic event to the seller will have greater control, complete knowledge of the risk, and spread of risk.

The Spread Strips computer system and method recombine the shape of the seller's risk density that has been identified and defined as being potentially impacted by a catastrophic event. The recombination of the risk density is done by a step by step process that can be clearly understood by referring to Figures 1-9.

The phenomenon selection step 12 is shown in Figs. 1 and 2. The phenomenon is selected by the public policy and financial consequences the seller may endure as a result of the phenomenon's impact. For example, the phenomenon of earthquake in the state of California is selected (and most likely in the near future the states of New York, Washington and Missouri will fall into the same category as California). The sellers of earthquake property insurance as well as sellers of municipal bonds were impacted financially by the Northridge earthquake in southern California. Consequently, the availability of earthquake coverage became difficult for the commercial buyer or homeowner to obtain or afford. A public policy issue of significant proportions emerged with the solution being short-term in the form of the California Earthquake Authority. There were

many insurance carriers who almost went insolent and lost a significant amount of capital. Not only could these insurance carriers not provide any or as much earthquake coverage but their ability to provide coverage other than earthquake to the consumer was greatly reduced. The costs today to the consumer are very high as well as the amount of earthquake coverage being less than what was provided before the Northridge earthquake. This can avoided in the future by spreading the risk between a larger group of risk takers instead of the few.

The seller selection step 14 is illustrated in Figs. 1 and 3. A seller is selected based on its financial ability to be aware and address the public policy issue of availability of catastrophic coverage at affordable costs to the consumer. For example, an insurance carrier writing in the state of Florida is concerned about its ability to obtain adequate hedging through reinsurance catastrophe excess coverage as well as adequate primary insurance rates for the peril exposure of hurricane. The seller provides the oDNA of the risk population for the purposes of risk density analysis and the decision of how much of the risk population will be extracted to put the seller in a position where they can maintain their financial position, market share, catastrophe coverage, primary pricing and even expand their risk population. In most cases, those established insurance carriers who have been writing property business over the last twenty years, will need to extract at least twenty-five per cent or more of their risk population where risk exposure to the selected phenomenon is very real.

The selection of risk step 16 is illustrated in Figs. 1 and 4. The type of risk sets the parameters for identifying and defining the risk's loci and financial value. The risk population data is oDNA provided by the seller via a database such as Microsoft Access® or Excel® on tape or floppy disk or CD. For example, the seller is an insurance carrier, the phenomenon is hurricane and the type of risk is a homeowner's insurance policy. The risk population size is 100,000 and consists of 100,000 rows by 19 columns. The data linked to each record enables a geographical information system to plot and assign latitude and longitude coordinates to each record and also allows for statistical analysis to be performed on selected numeric fields for the purposes of minimum distances between each

and every risk, and damage assessment to the risk units as a consequence of a catastrophic event.

Up to this point, steps 12, 14 and 16 can be performed manually.

The consumer has equity tied to their home ... can they obtain adequate catastrophe coverage, pricing and a reasonable deductible? Is there an insurance market available to write assume the risk?

The step 18 of creating a surface structure and linking it to selection of risk is illustrated in Figs. 1 and 5. This step 18 and steps 20 – 28 are preferably performed on a computer. Selection of the surface structure is paramount to the values derived from the deep structure of the risk type. The surface structure is the topology that matches the phenomenon to the seller to the type of risk. For example, in Florida the topology selected for the phenomenon of hurricane, type of insurance carrier and type of insurance policy is geographical, atmospheric, sea surface temperatures, architecture, paths and associated attributes for past hurricanes. This surface structure selection is the foundation for the estimation of the probable maximum loss to risk units in the path of the simulated phenomenon of hurricane.

The step 20 of determining deep structural attributes is illustrated in Figs. 1 and 6. The deep structure attributes are obtained from the seller's oDNA and are converted into a dBase file format which allow for the permutation and random order of the insurance policy's attributes both qualitatively and quantitatively. A deep structure is the hierarchical ranking of attributes associated with the type of phenomenon, the type of seller, the type of risk and the selected surface structure. For example, the attributes of the deep structure are driven by the risk type, in this example, an insurance policy. The oDNA attributes are as follows:

1. Policy N
2. Policy Type
3. Address
4. City
5. State
6. Zip Code
7. Zip+4
8. Zip+3
9. Coverage A

10. Coverage B
11. Coverage C
12. Deductible
13. Year
14. Day
15. Month
16. Premium
17. Latitude
18. Longitude

The step 22 of computing an oDNA is also illustrated in Figs. 1 and 6. The original defined numeric alpha known as oDNA is the seller's universe of risk type most likely to be impacted by the selected phenomenon, measurable by the the surface structure and definable by the deep structure. For example, the insurance policy limit exposed and provides coverage for the phenomenon of hurricane is selected and becomes part of the seller's oDNA. The selection of all insurance policies that fit the criteria of exposure to and coverage for the phenomenon of hurricane become part of the oDNA provided by the insurance carrier. The oDNA universe is, typically, 100,000 records with 100,000 columns by 19 rows.

The step 24 of computing the rDNA from selected oDNA is illustrated in Figs. 1 and 7. A random defined numeric alpha known as rDNA is derived from the historical slicing of the seller's oDNA. For example, the oDNA is 100,000 risk units and these risks are divided into four historical populations by first year of issuance. The first population consists of 25,000 risk units which are 30 years or older. The second population is 20 years old but less than 30 years and so on. These populations are permutated and integrated to form strands of risks that conform to the seller's original geographical spread but not their density. By taking strands from each historical slice the buyer is assuming a truer historical mix of the risk population as well as the historical geographical distribution and conformity.

The step 26 of computing the SDR is illustrated in Figs. 1 and 8. The spread deficit ratio, or SDR, is the calculation of the surface structure topology to the area occupied by the type of risk. For example, the topology related to the geographical space for the phenomenon of hurricane will be divided into zip code

attributes and the type of risk will be a single-family dwelling. The maximum spread deficit ratio is fifty percent. Any ratio equal to or greater than fifty percent represents a vertical curve which indicates the seller's risk portfolio is highly exposed to a catastrophic event. If the SDF is less than fifty percent, the risk portfolio is moving toward a horizontal shape and is less likely to be impacted by a catastrophic event in proportion to the spread deficit ratio moving towards zero. The SDF variables are as follows:

r_i	=	risk unit, exposure "mean, median, mode" area squared
k_j	=	kernel, zip+4 "actual" area squared
ph_k	=	phenomenon, catastrophic event simulated "polygon, vortex, rectangle" area squared
zc_L	=	zip code, boundary "actual" area squared
zp_M	=	zip3, boundary "actual" area squared

The first step is the number of risk units within a kernel or 9-digit zip code;

$$
\begin{aligned}
r_1 &= 5 * 2{,}000 \text{ square feet} \\
&= 10{,}000 \text{ square feet} \\
k_1 &= 1{,}000{,}000 \text{ square feet} \\
r_1/k_1 &= .01 \\
&= \\
&\vdots \\
&= n
\end{aligned}
$$

The next step is to calculate those kernels that fit a non-linear path (to offset the path of a hurricane) and fall within a 5-digit zip code;

$$
\begin{aligned}
zc_1 &= 200{,}000{,}000 \text{ square feet} \\
&= \Sigma\, k_i/zc_1 \\
&= 150{,}000{,}000/200{,}000{,}000
\end{aligned}
$$

$$= .75$$

The next step is to calculate those zip codes that fit a non-linear path (to offset the path of a hurricane) and fit within a 3-digit zip code;

$$zp_m = 450{,}000{,}000$$

$$\Sigma zc = 150{,}000{,}000$$

$$= \Sigma zc/zp_m$$

$$= 150{,}000{,}000/450{,}000{,}000$$

$$= .3333$$

The SDR for the three subsets indicate that the seller has high exposure in the defined zip code spaces and, therefore, a number of vertical shapes emerge.

The next step is to calculate the number of the risk units that fit within all the zip code attributes and fall within the selected simulated path of a hurricane.

ph_{1950} = simulated polygon path derived from historical hurricane

$$ph_{1950} = 23{,}000{,}000{,}000$$

$$\Sigma zc/ph_{1950} = 2{,}250{,}000{,}000$$

$$\Sigma zc/ph_{1950} = 2{,}250{,}000{,}000/23{,}000{,}000{,}000$$

SDR = .098 market share loss

The step 28 of computing Spread Strip bundles is illustrated in Figs. 1 and 8. Spread Strips are generated from the extraction of risks found in the SDR population where greater than one risk exists and falls within the zip code boundaries of the defined phenomenon. This extraction process is the reverse of the SDR since the distribution curve does not identify or define vertical curves but insures that the SDR ratio will be less than fifty percent. Consequently, a spread strip string becomes a multiple of horizontal curves where the ratio of the risk area

to the 3-5-9 digit zip code is less than twenty-five percent and stretches across the entire geographical space occupied by the seller's oDNA. The iteration of each subset of the rDNA within each defined zip code boundary generates a spread strips risk unit which moves forward to the next extraction and so on, until there are no more zip code boundaries with risk units. At the end of the iteration the risks will form a string, in the case of hurricane the string will be non-linear. This process will continue until all fifty thousand risks units have been extracted. For example, the phenomenon is hurricane, the seller is the insurance carrier, the type of risk is an insurance policy for homeowners, the surface structure is geographical, atmospheric..., the deep structure is a series of attributes derived from the homeowners insurance policy, the oDNA population size is one hundred thousand, the rDNA derived from the oDNA is fifty thousand, the SDR identifies and defines the vertical and horizontal distributions and the Spread Strips formed are a result of the strings generated from the iteration of the rDNA. The number of strings generated is fifty, these strings will be divided by ten generating five strings per bundle, and creating ten bundles of spread strips. The five strings will be cross-checked for minimum distance violations and released to the buyer.

The Spread Strips bundle will be defined by an occurrence limit which is six times one hundred percent of the peril (hurricane) premium of one million dollars equaling six million dollars. The aggregate limit is twelve times the premium equaling twelve million dollars. Eighty per cent of premium will be paid quarterly in advance and thirty per cent profit commission will be paid after the reinsurer's expense of twenty per cent. The first adjustment will be twelve months after the first annual period. The maximum policy limit per risk is three hundred and fifty thousand dollars. The minimum distance between each and every risk is one half mile. One hundred per cent of the risks are one half mile from one another, ninety-eight are three to five miles from one another and so on. All attributes for each and every risk is transferred to dBase file and copied to 3 ½" floppy disk.

The last, and final, step 30 of selling the Spread Strips to a buyer is also shown in Figs. 1 and 8. This step is usually performed manually since the target

purchaser is usually known in advance. The buyer of Spread Strips can be reinsurance companies, single parent captives, life insurers and capital markets for securtization. For example, the ten Spread Strips bundles generate sixty million of occurrence coverage and aggregate coverage of one hundred and twenty million. The reinsurance market authorizes twenty million dollars per occurrence and forty million dollars of aggregate coverage. The only other authorization is from the capital market for forty million dollars occurrence coverage and eighty million dollars of aggregate coverage, whose authorization can be securitized and passed through an authorized reinsurer. The buyer ends up with sixty million dollars of capital per occurrence and one hundred and twenty million of capital per an annual aggregate limit.

An additional step may take place within a specific Spread Strip bundle and that step comprises examining the risks within each Spread Strip bundle and rejecting at least one of each pair of adjacent risks that are located too close to each other. In other words, each specific risk R_x that lies within a minimum distance D_{min} from an adjacent risk R_{x+1} will be excluded from the bundle and, perhaps, replaced with another risk R_{x+n} that is over D_{min} from R_x and otherwise fits the criteria for inclusion in the Spread Strip bundle.

In summary, steps 12 – 16 are typically performed manually, steps 18 – 28 are performed by computer, and final step 30 is manual in the sense that the buyer of the product is typically known in advance of the calculations. For this system a computer having a 200 Pentium® MX Intel processor, with 128 megabytes of RAM and 9.0 gigabytes of hard drive was employed. Such a system configuration can process a table of data of 1,000,000 rows and 13 – 19 columns in about two (2) weeks time.

The Spread Strips method can:

1. reduce the seller's risk capital allocated to catastrophic exposure;
2. reduce fluctuations in the seller's earning pattern;
3. reduce the seller's catastrophe costs
4. increase the seller's spread of risk
5. reduce the seller's peaks of highly exposed areas of risk

6. enable the seller to maintain market share
7. enable the seller to increase market share
8. enable the seller to reduce market share
9. increase the seller's capital
10. enable the seller to cede one hundred percent of the peril risk (e.g., earthquake, hurricane...) on first dollar basis
11. enable the seller to convert potentially non-performing catastrophic assets (e.g., earthquake, hurricane...) into performing assets
12. provide the buyer complete knowledge of the risk being assumed from the buyer
13. immunize the buyer to rate fluctuations experienced in the excess or other hedge markets
14. provide the buyer a static risk portfolio that can only decrease through attrition
15. provide the buyer with one hundred percent of peril premium
16. provide the buyer risk spread between each and every risk
17. provide the buyer risk spread via a series of horizontal distributions over a large topological space
18. provide the consumer with stable rates
19. provide the consumer with peril coverage at affordable prices
20. provide the consumer with peril coverage
21. provide the consumer broader coverage as a result of seller's increase capital for other risk ventures

The surface structure of Spread Strips is determined by the phenomenon linked to both the types of buyer and the risk. For example:

1. the catastrophic phenomenon is earthquake
2. the seller is an insurance company
3. the seller's risk unit is an insurance policy
4. the surface structure topology is geophysical

A surface structure provides the template for the population risks. The selection of the surface structure is essential for the recombination of the seller's

risk population to potential buyers. Selecting a surface structure is predetermined by the type of phenomenon, seller and risk.

The deep structure is the attributes of the risk resting on the surface structure. Attributes selected have a shared commonality between the phenomenon, seller, risk and surface structure selection.

As shown in Fig. 10, the oDNA's surface and deep structure identifies, defines and generates the outcomes applicable to the catastrophic phenomenon impacting the seller's type of risk. The surface structure provides the ethnography of the oDNA whereas, the deep structure provides the ethnology of the oDNA.

The deep structure represents the hierarchical root system of the surface structure risk. One set of attributes can be linked to an insurance property policy:

1. policy number
2. business type
3. address
4. city
5. zip code
6. zip4
7. zip3
8. .
9. .
10. .
11. n

The Spread Strips computer system and method recombines the risk shape of the seller's original Defined Numeric Alpha (oDNA) into random Defined Numeric Alpha (rDNA). ODNA is the data linked to the seller's commodity and is sanitized and sold to the buyer.

Figure 11 illustrates a singular oDNA with significant risk density, i.e., vertical shape or peak or any particular part of the topology can be impacted by a catastrophic event.

Risk shapes that are generated are either vertical or horizontal. The objective of the Spread Strips method is to ensure that the rDNA strands generated from the oDNA have horizontal shapes that cannot have a deleterious effect on a bundle of strands as a whole.

Figure 12 illustrates a bundle of rDNA strands derived from a permutation of oDNAs and related subsets. The rDNA has spread of risk between each and every risk by strand. Any violation where two risks per strand or overlapping strands occupying the same space, one risk will be extracted.

These attributes are permuted into a series of spread deficit ratios (SDRs). The spread deficit ratio (SDR) generates two types of risk shapes or distributions: vertical and horizontal. A vertical shape is defined as having a peak and captures a large number of overlapping risks within a pixel or frame. Whereas, a horizontal shape is relatively flat and captures a small number of risks that are specifically located by a predetermined criteria of spread.

Figure 13 illustrates a singular frame or pixel identifying the risk density through vertical and horizontal shapes.

As shown in Figure 14, one of the spread deficit ratios (SDR) sums the number of risks that overlap the same space as defined by the minimum distance requirement, which is divided by the total number of risks within a defined boundary. For example, no risk will be within .15 mile of any other risk, otherwise, it will be considered a spread strip violation.

Figure 15 illustrates another SDR in which the number of risk units and their associated area is divided by the area of a selected attribute. For example, the total area of homeowners risks divided by the area of the zip code, zip+4 and zip3. This ratio generates the height of the vertical and horizontal shapes.

While the invention has been described with reference to the preferred embodiment thereof, it will be appreciated by those of ordinary skill in the art that various modifications can be made to the system and steps of the method without departing from the spirit and scope of the invention as a whole.

WHAT IS CLAIMED IS:

1. A method of grouping discrete risks into bundles using a computer system comprising the steps of:

a. selecting a specific type of catastrophic risk phenomenon;
b. linking the selected catastrophic risk phenomenon to a seller of a financial product covering the type of risk of said catastrophic phenomenon;
c. linking the type of said selected catastrophic risk phenomenon to the type of said seller selling said product;
d. generating a surface structure having deep structure attributes and linking said surface structure to the selected type of catastrophic risk phenomenon;
e. generating original Defined Numeric Alphas (oDNAs) from the deep structure attributes of said surface structure;
f. generating random Defined Numeric Alphas (rDNAs) from selected oDNAs;
g. generating a Spread Deficit Ratio (SDR) from said oDNAs; and,
h. generating an acceptance string of risks from said SDR and grouping said string into a bundle,

wherein said bundles of risks may be distributed to third parties.

2. The method of claim 1 wherein selection step a. comprises the step of selecting either a natural or a man-made catastrophic risk phenomenon.

3. The method of claim 2 wherein linking step b. comprises the linking of either insurance or a financial product seller with said selected catastrophic risk phenomenon.

4. The method of claim 3 wherein said surface structure generated in step d. can be either natural or man-made.

5. The method of claim 4 wherein said deep structure attributes of step d. may be either insurance or financial product attributes.

6. The method of claim 5 wherein said step f. for generating rDNAs further includes the steps of:

i. selectively splitting oDNAs;

j. performing a population match of oDNAs; and,

k. recombining oDNA matches to generate said rDNAs.

7. The method of claim 6 wherein said step h. for generating an acceptance string from said SDR includes the steps of:

l. selecting deep structure attributes;

m. generating a ratio therefrom;

n. deriving a vertical shape from said ratio;

o. generating a transformation string from said vertical shape;

p. generating a horizontal shape from said transformation string and said ratio; and,

q. generating said acceptance string from said horizontal shape.

8. The method of claim 7 further comprising the step of:

r. examining each risk in a proposed bundle and rejecting those that fall within a minimum distance D_{min} from the closest adjacent risk within the same bundle.

9. A method of grouping discrete risks related to catastrophic risk phenomenon into bundles using a computer system comprising the steps of:

a. generating a surface structure having deep structure attributes and linking said surface structure to a selected type of catastrophic risk phenomenon;

b. generating original Defined Numeric Alphas (oDNAs) from the deep structure attributes of said surface structure;

c. generating random Defined Numeric Alphas (rDNAs) from selected oDNAs;

d. generating a Spread Deficit Ratio (SDR) from said oDNAs; and,

e. generating an acceptance string of risks from said SDR and grouping said string into a bundle,

wherein said bundles of risks may be distributed to third parties who wish to share in said risk and minimize loss exposure.

10. The method of claim 9 wherein said surface structure generated in step a can be either natural or man-made.

11. The method of claim 10 wherein said deep structure attributes of step b. may be either insurance or financial product attributes.

12. The method of claim 11 wherein said step c for generating rDNAs further includes the steps of:

f. selectively splitting oDNA's;

g. performing a population match of oDNA's; and,

h. recombining oDNA matches to generate said rDNAs.

13. The method of claim 12 wherein said step e for generating an acceptance string from said SDR includes the steps of:

i. selecting deep structure attributes;

j. generating a ratio therefrom;

k. deriving a vertical shape from said ratio;

l. generating a transformation string from said vertical shape;

m. generating a horizontal shape from said transformation string and said ratio; and,

n. generating said acceptance string from said horizontal shape.

14. The method of claim 13 further comprising the step of:

o. examining each risk in a proposed bundle and rejecting those that fall within a minimum distance D_{min} from the closest adjacent risk within the same bundle.

15. A computer system for grouping discrete risks related to catastrophic risk phenomenon into bundles comprising:

a. means for generating a surface structure having deep structure attributes and linking said surface structure to a selected type of catastrophic risk phenomenon;

b. means for generating original Defined Numeric Alphas (oDNAs) from the deep structure attributes of said surface structure;

c. means for generating random Defined Numeric Alphas (rDNAs) from selected oDNAs;

d. means for generating a Spread Deficit Ratio (SDR) from said oDNAs; and,

e. means for generating an acceptance string of risks from said SDR and grouping said string into a bundle,

wherein said bundles of risks may be distributed to third parties who wish to share in said risk and minimize loss exposure.

16. The computer system of claim 15 wherein said surface structure can be either natural or man-made.

17. The computer system of claim 16 wherein said deep structure attributes may be either insurance or financial product attributes.

18. The computer system of claim 17 wherein said means for generating rDNAs further includes:

f. means for selectively splitting oDNAs;

g. means for performing a population match of oDNAs; and,

h. means for recombining oDNA matches to generate said rDNAs.

19. The computer system of claim 18 wherein said means for generating an acceptance string from said SDR includes:

i. means for selecting deep structure attributes;

j. means for generating a ratio therefrom;

k. means for deriving a vertical shape from said ratio;

l. means for generating a transformation string from said vertical shape;

m. means for generating a horizontal shape from said transformation string and said ratio; and,

n. means for generating said acceptance string from said horizontal shape.

20. The computer system of claim 19 further including:

o. means for examining each risk in a proposed bundle and rejecting those that fall within a minimum distance D_{min} from the closest adjacent risk within the same bundle.

21. The computer system of claim 15 wherein said geographical distribution of the risks in the bundle is substantially similar to the geographical distribution of the risk distribution from which the bundle was formed.

FIG. 1

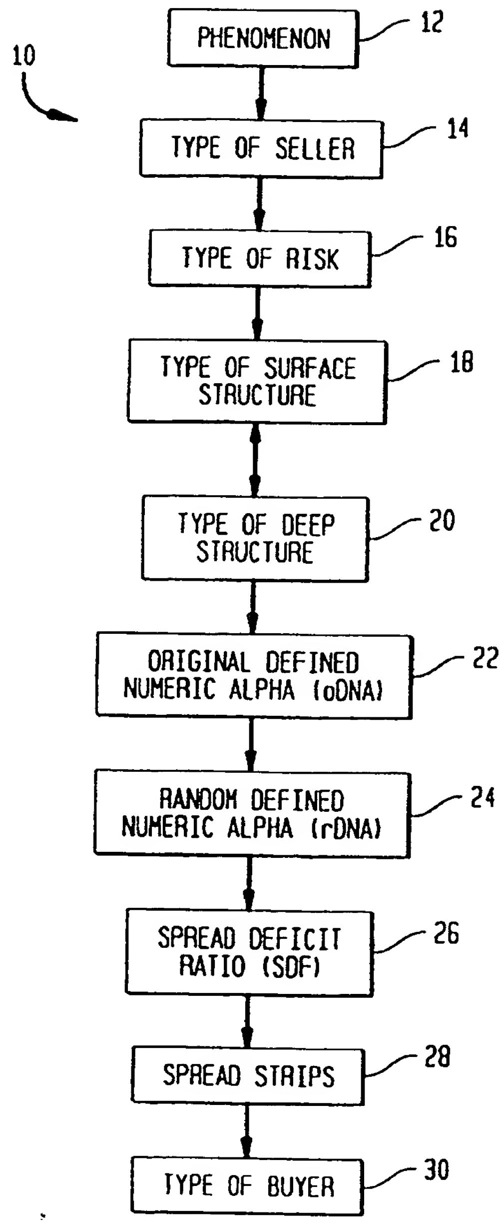

10
PHENOMENON
12
TYPE OF SELLER
14
TYPE OF RISK
16
TYPE OF SURFACE STRUCTURE
18
TYPE OF DEEP STRUCTURE
20
ORIGINAL DEFINED NUMERIC ALPHA (oDNA)
22
RANDOM DEFINED NUMERIC ALPHA (rDNA)
24
SPREAD DEFICIT RATIO (SDF)
26
SPREAD STRIPS
28
TYPE OF BUYER
30

FIG. 2

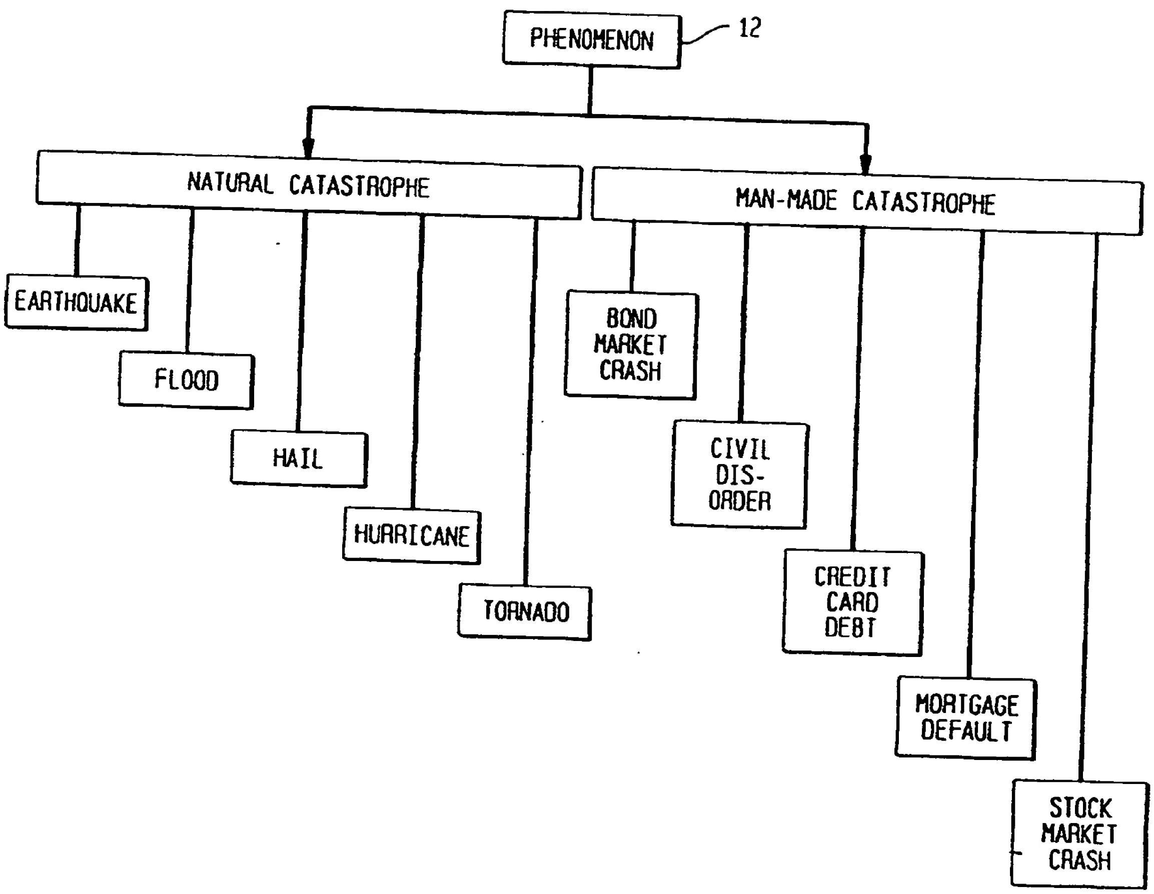

PHENOMENON
12
NATURAL CATASTROPHE
MAN-MADE CATASTROPHE
EARTHQUAKE
FLOOD
HAIL
HURRICANE
TORNADO
BOND MARKET CRASH
CIVIL DIS-ORDER
CREDIT CARD DEBT
MORTGAGE DEFAULT
STOCK MARKET CRASH

FIG. 3

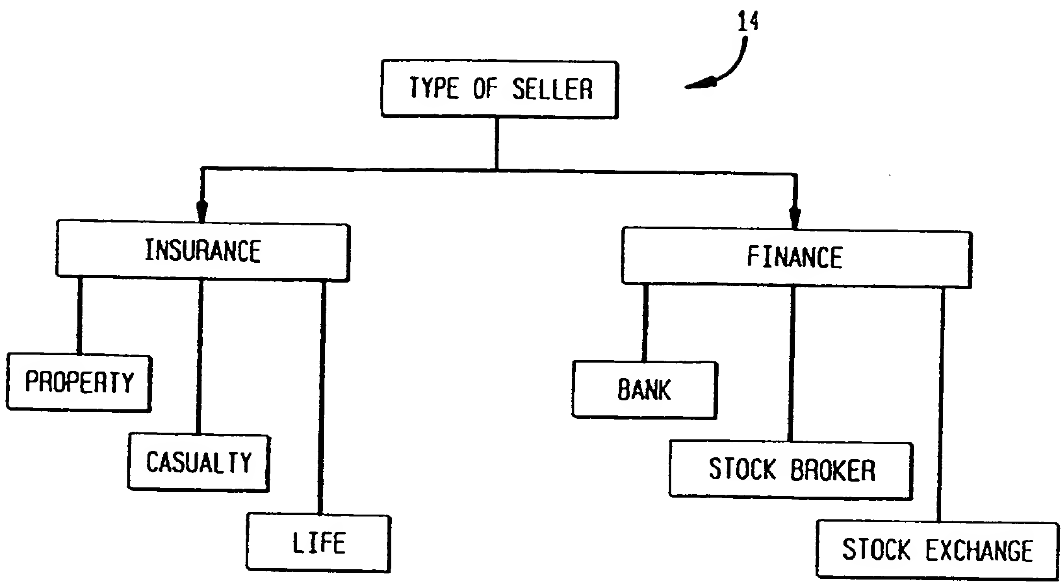

14
TYPE OF SELLER
INSURANCE
FINANCE
PROPERTY
CASUALTY
LIFE
BANK
STOCK BROKER
STOCK EXCHANGE

FIG. 4

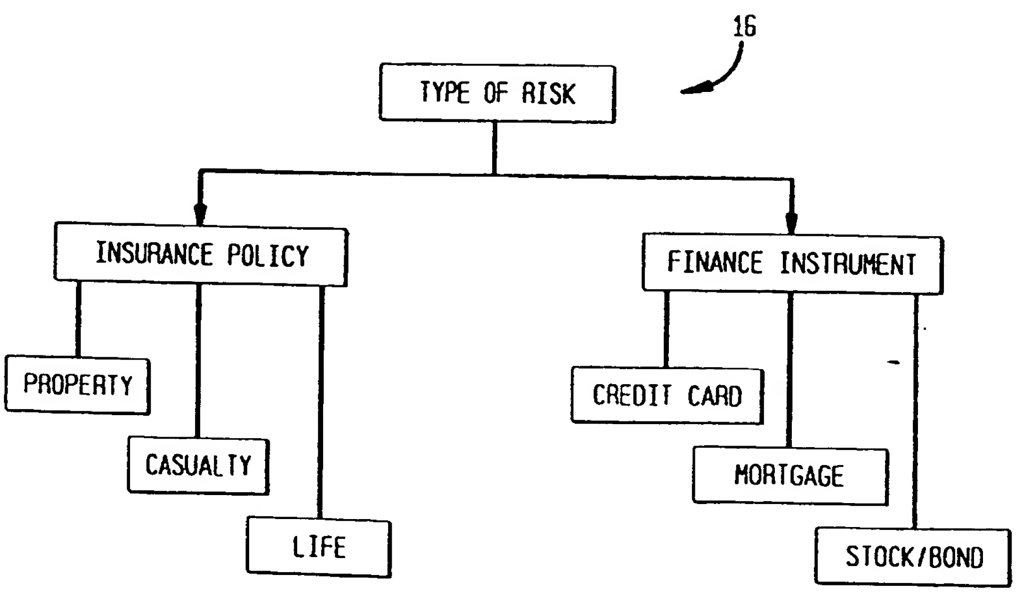

16
TYPE OF RISK
INSURANCE POLICY
FINANCE INSTRUMENT
PROPERTY
CASUALTY
LIFE
CREDIT CARD
MORTGAGE
STOCK/BOND

FIG. 5

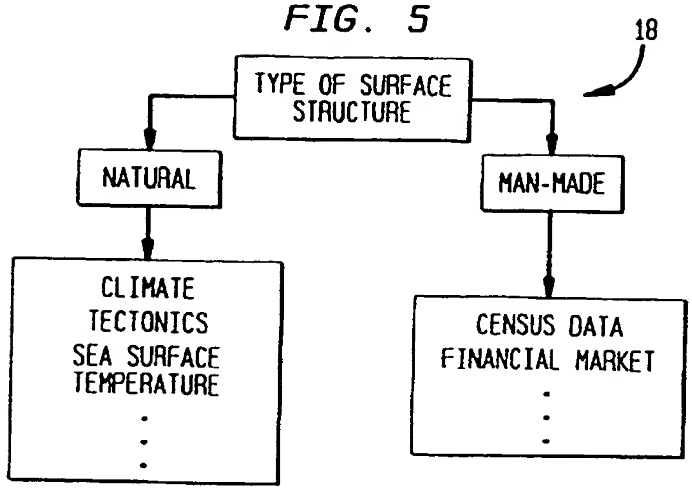

18
TYPE OF SURFACE STRUCTURE
NATURAL
MAN-MADE
CLIMATE
TECTONICS
SEA SURFACE TEMPERATURE
CENSUS DATA
FINANCIAL MARKET

FIG. 6

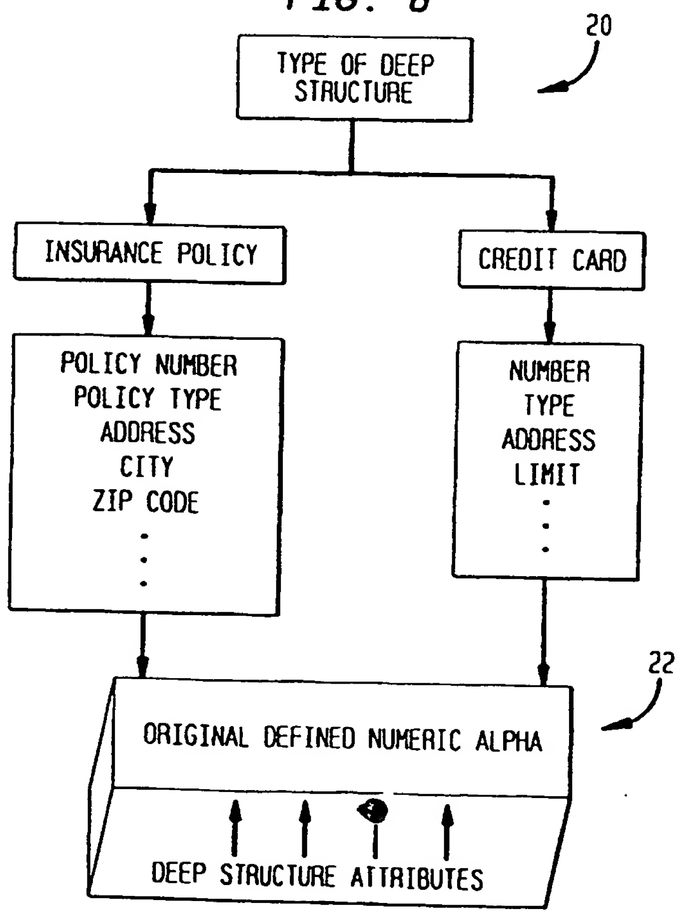

20
TYPE OF DEEP STRUCTURE
INSURANCE POLICY
CREDIT CARD
POLICY NUMBER
POLICY TYPE
ADDRESS
CITY
ZIP CODE
NUMBER
TYPE
ADDRESS
LIMIT
22
ORIGINAL DEFINED NUMERIC ALPHA
DEEP STRUCTURE ATTRIBUTES

FIG. 7

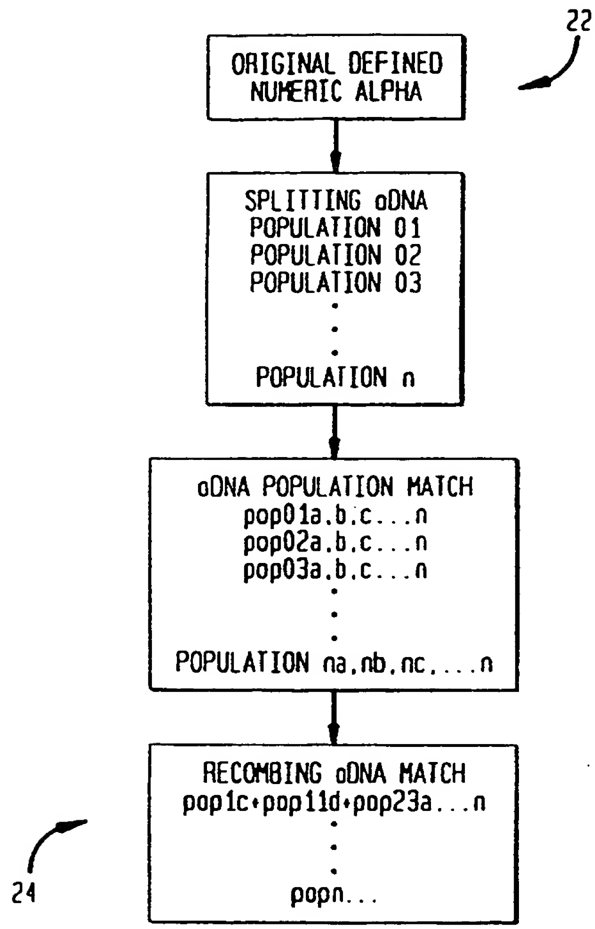

22
ORIGINAL DEFINED NUMERIC ALPHA
SPLITTING oDNA
POPULATION 01
POPULATION 02
POPULATION 03
POPULATION n
oDNA POPULATION MATCH
pop01a.b.c...n
pop02a.b.c...n
pop03a.b.c...n
POPULATION na.nb.nc....n
RECOMBING oDNA MATCH
pop1c+pop11d+pop23a...n
popn...
24

FIG. 8

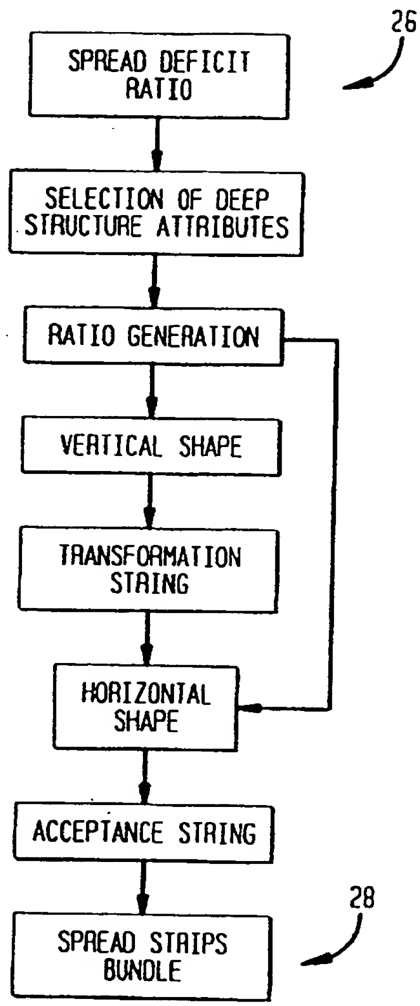

26
SPREAD DEFICIT RATIO
SELECTION OF DEEP STRUCTURE ATTRIBUTES
RATIO GENERATION
VERTICAL SHAPE
TRANSFORMATION STRING
HORIZONTAL SHAPE
ACCEPTANCE STRING
28
SPREAD STRIPS BUNDLE

FIG. 9

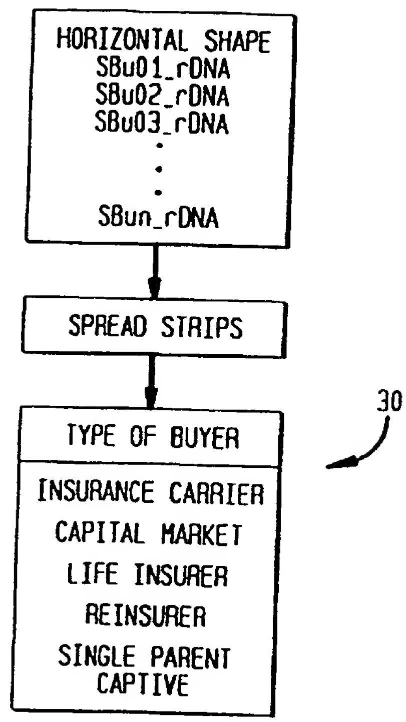

HORIZONTAL SHAPE
SBu01_rDNA
SBu02_rDNA
SBu03_rDNA
SBun_rDNA
SPREAD STRIPS
TYPE OF BUYER
INSURANCE CARRIER
CAPITAL MARKET
LIFE INSURER
REINSURER
SINGLE PARENT CAPTIVE
30

FIG. 10

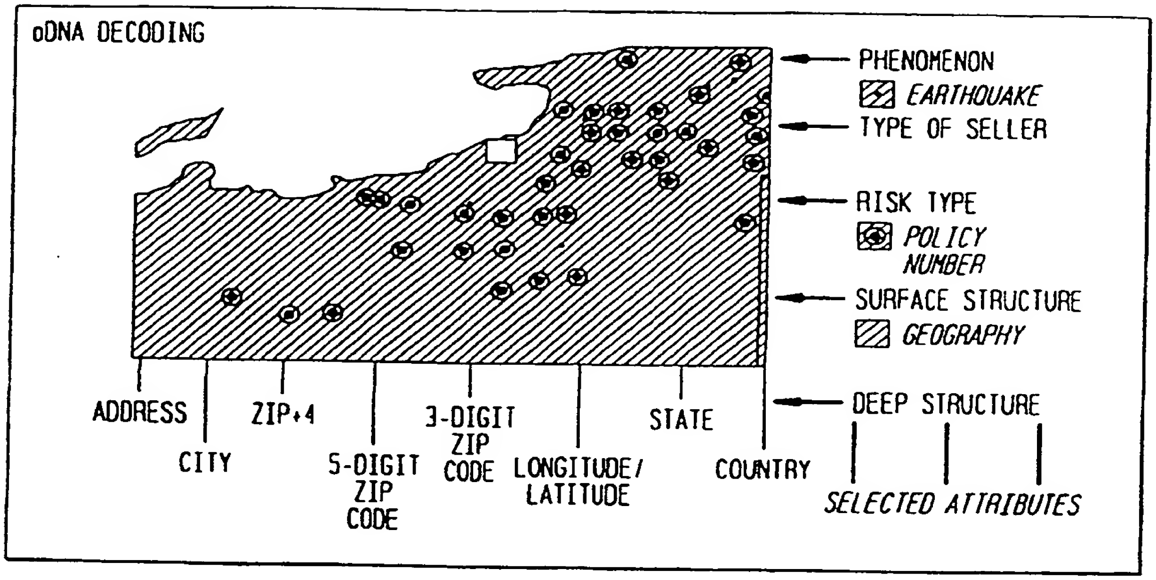

oDNA DECODING
PHENOMENON
EARTHQUAKE
TYPE OF SELLER
RISK TYPE
POLICY NUMBER
SURFACE STRUCTURE
GEOGRAPHY
DEEP STRUCTURE
ADDRESS
CITY
ZIP+4
5-DIGIT ZIP CODE
3-DIGIT ZIP CODE
LONGITUDE/ LATITUDE
STATE
COUNTRY
SELECTED ATTRIBUTES

FIG. 11

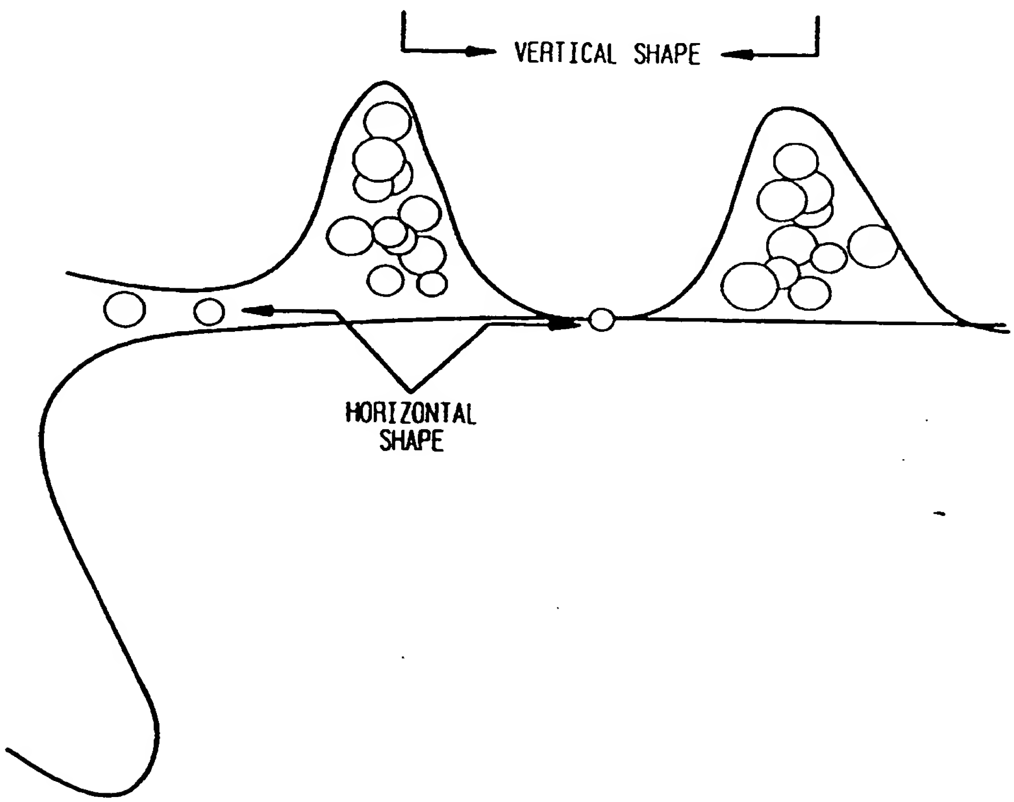

VERTICAL SHAPE
HORIZONTAL SHAPE

FIG. 12

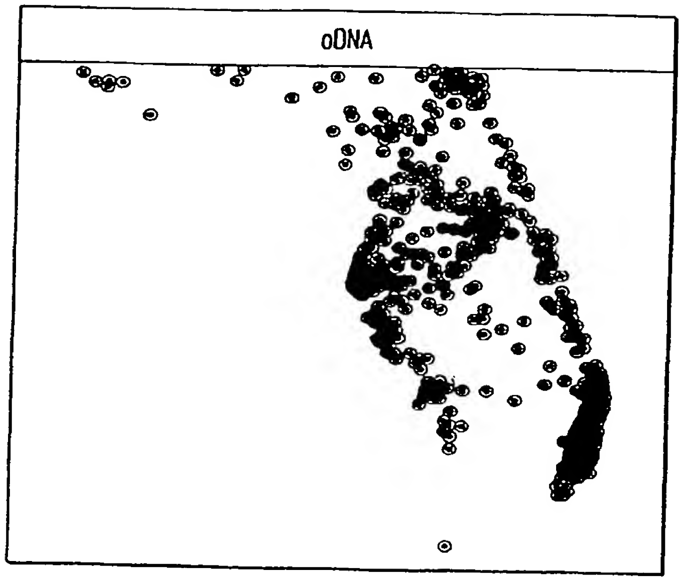


FIG. 13

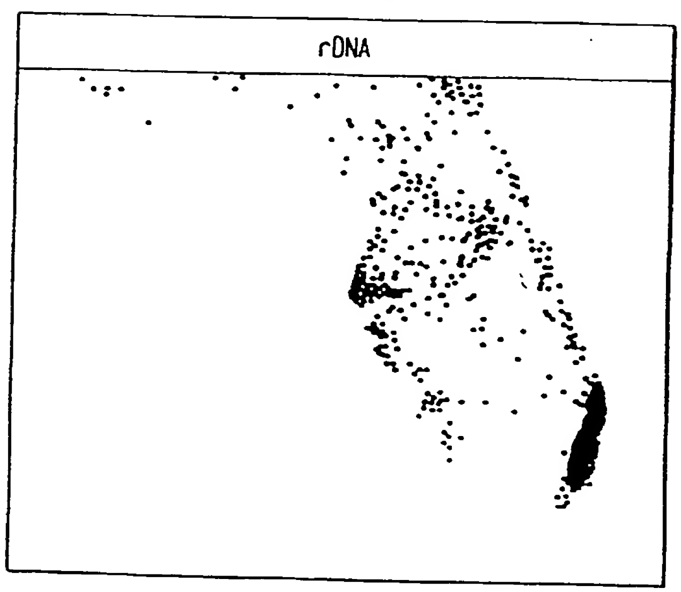
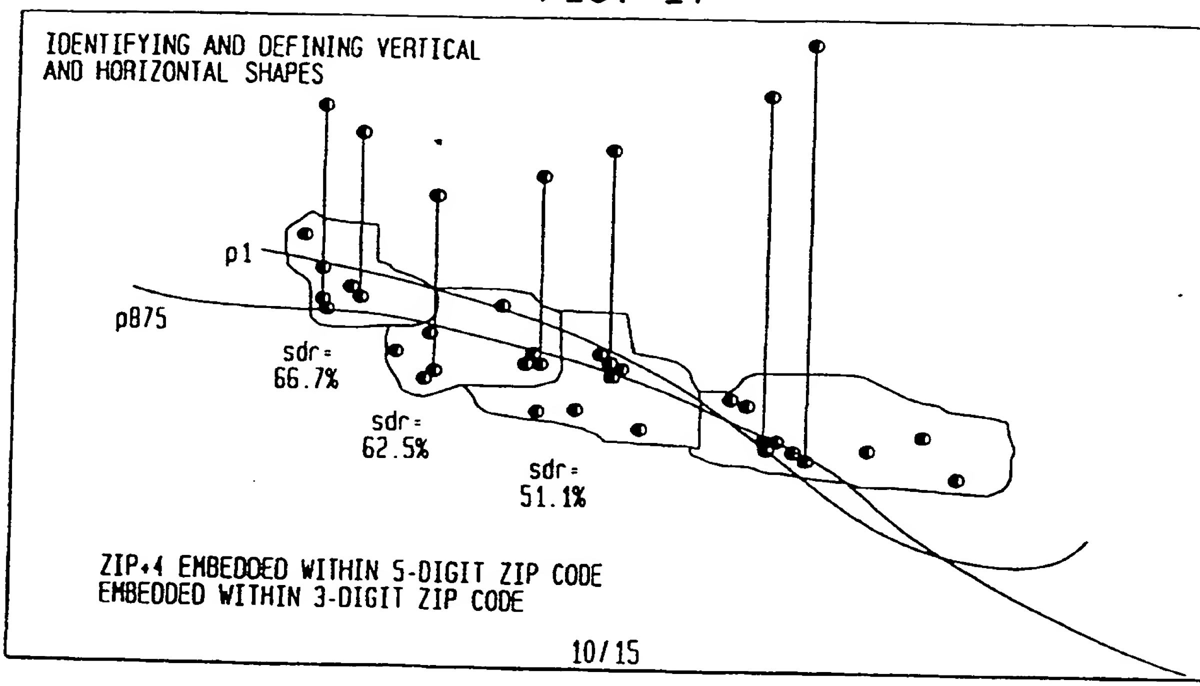


FIG. 14



10/15

FIG. 15

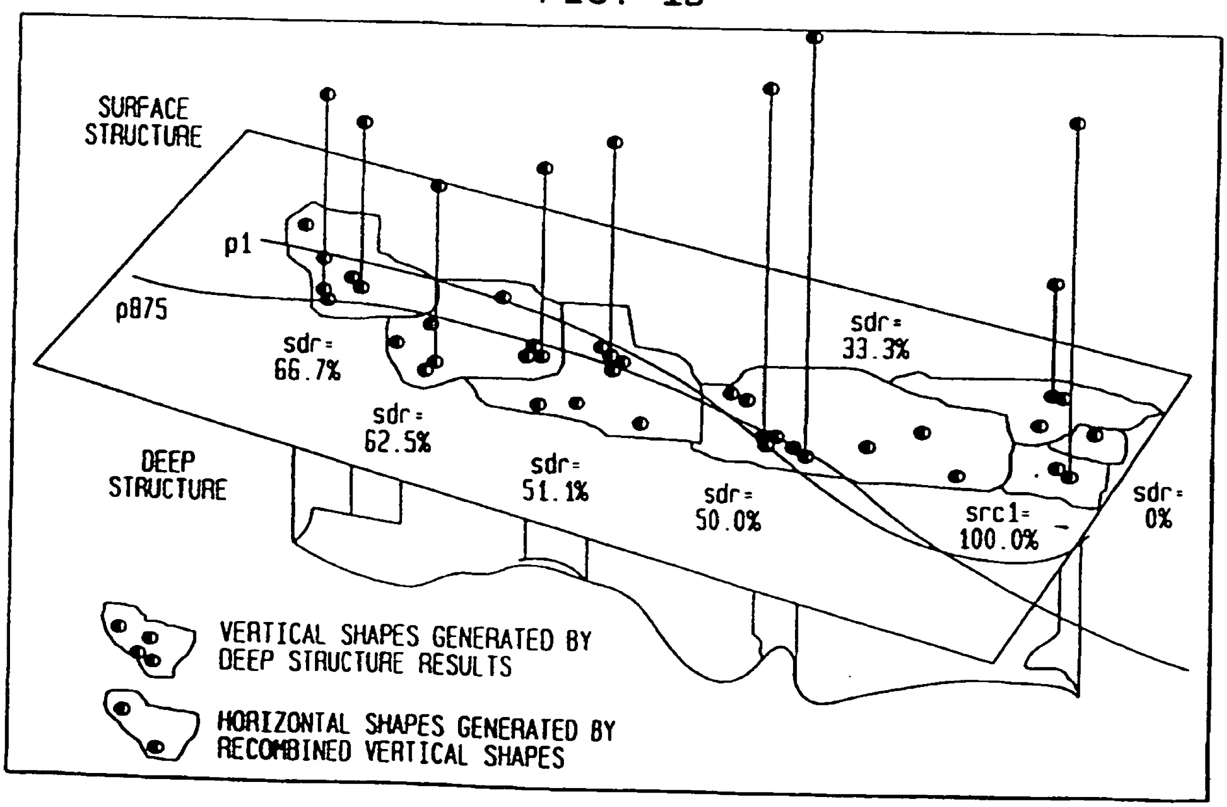


FIG. 16A

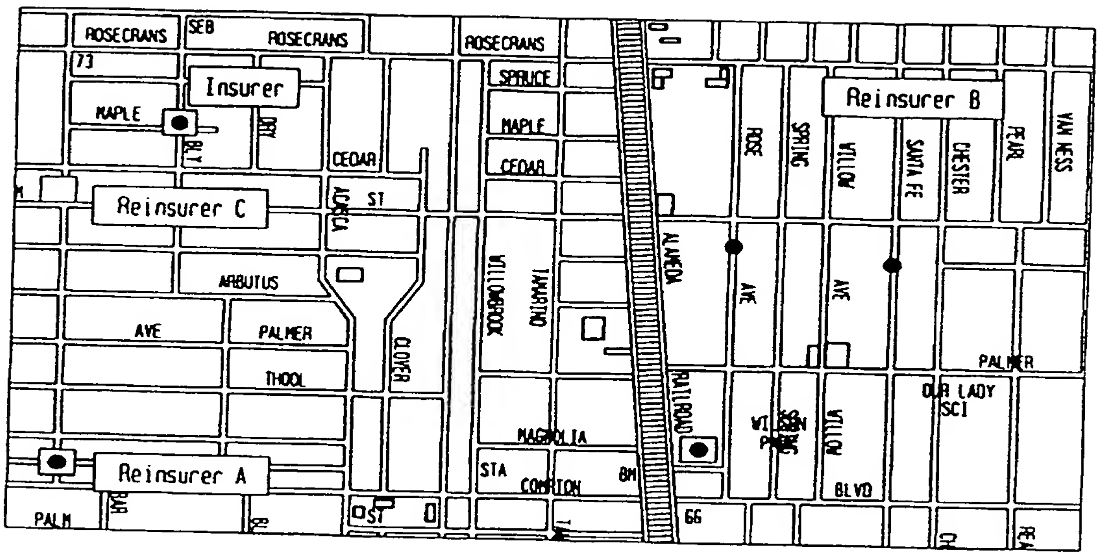


FIG. 16B

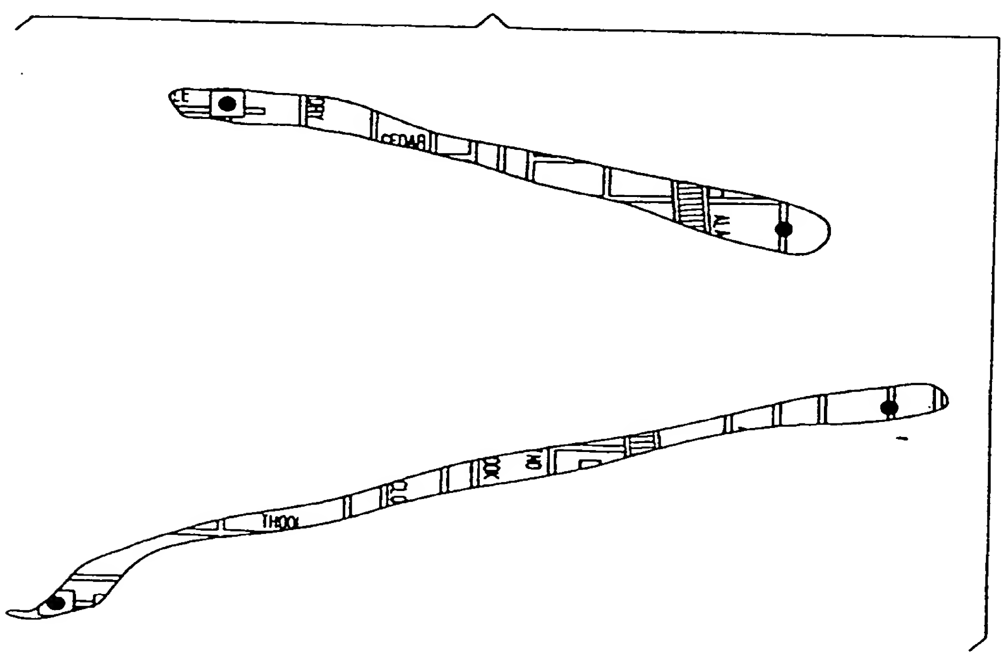


FIG. 16C

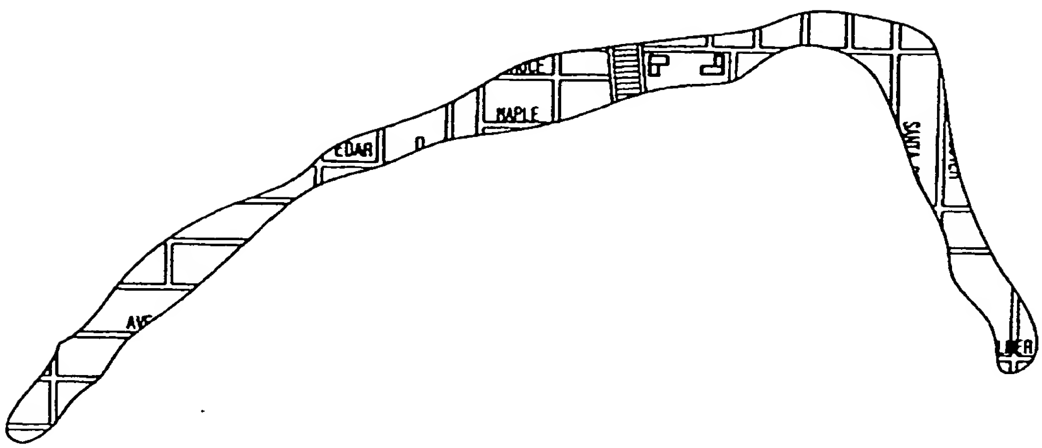


FIG. 16D

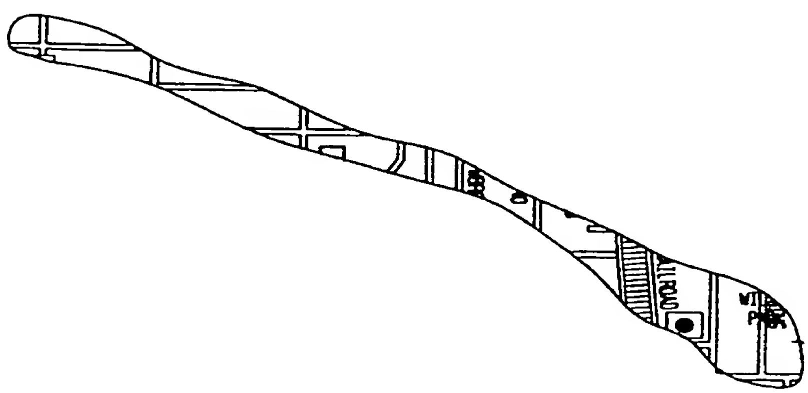


FIG. 17A

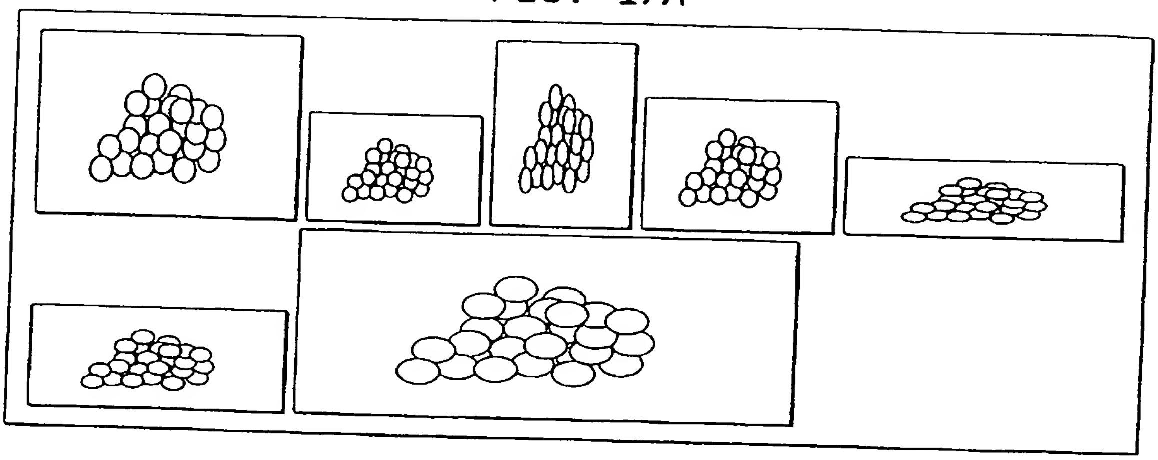


FIG. 17B

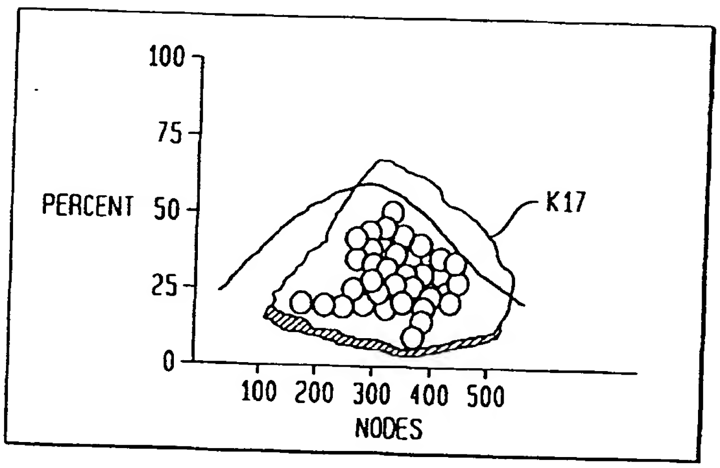


FIG. 17C

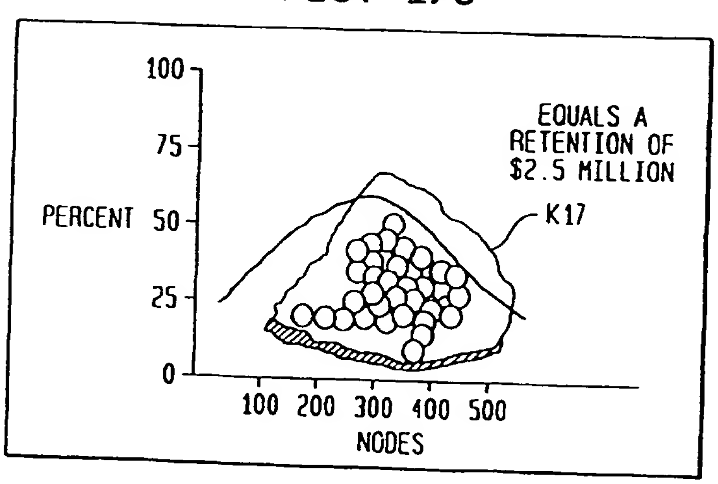


FIG. 17D

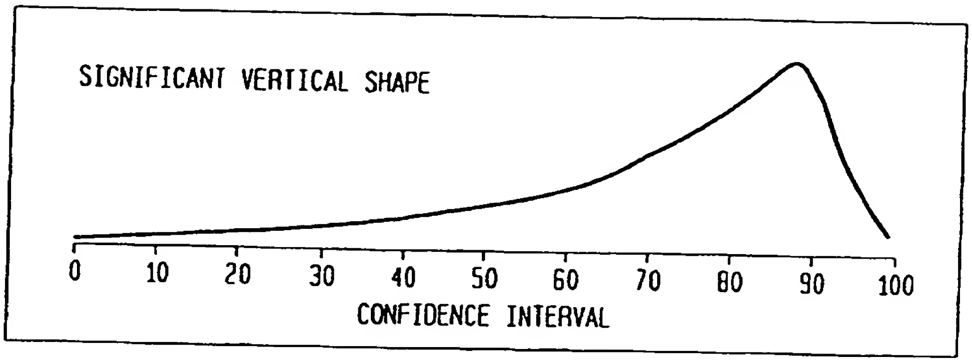


FIG. 17E

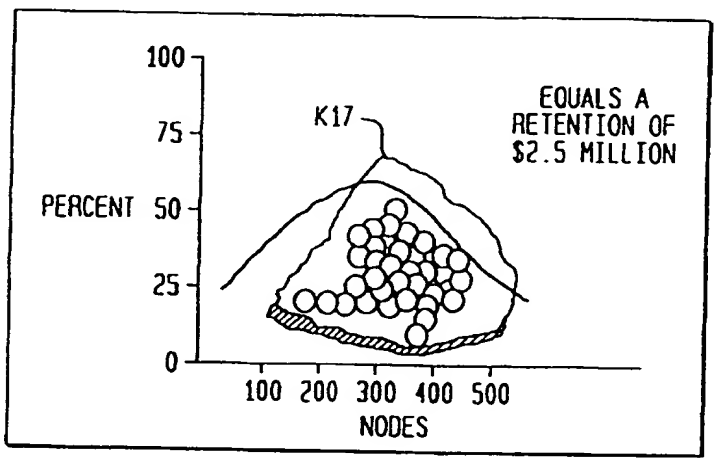


FIG. 17F

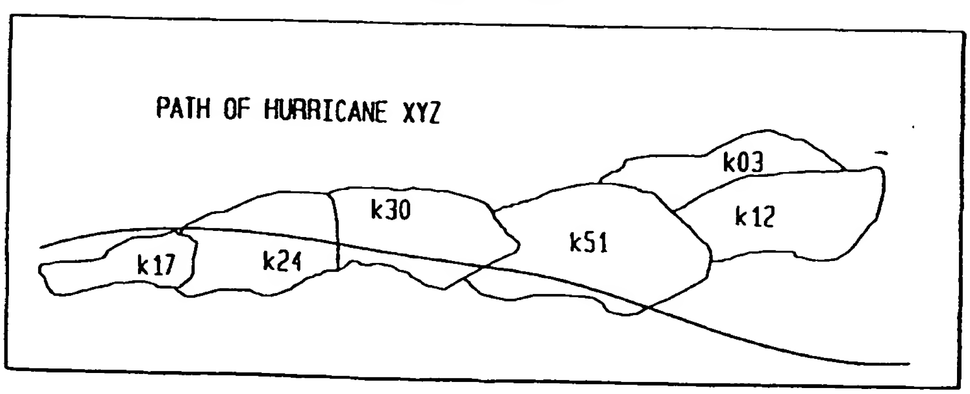


FIG. 18A

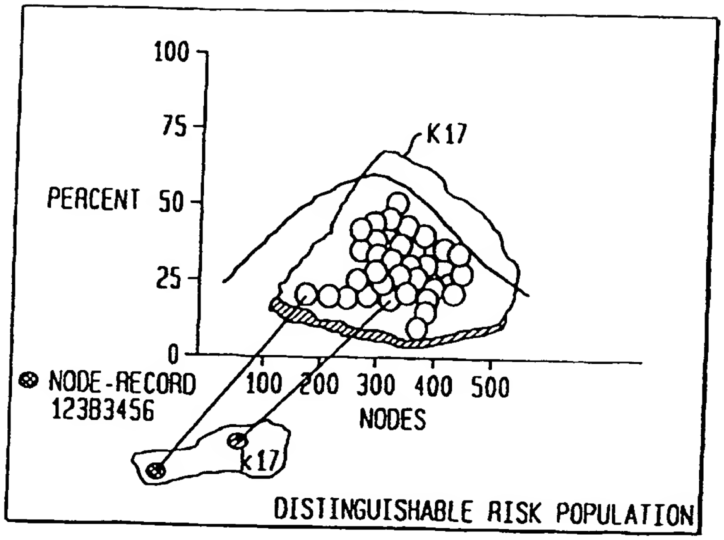


FIG. 18B

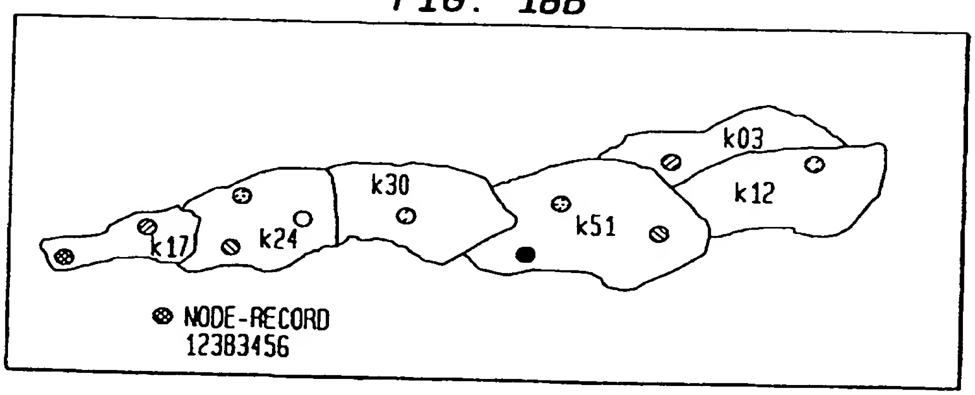
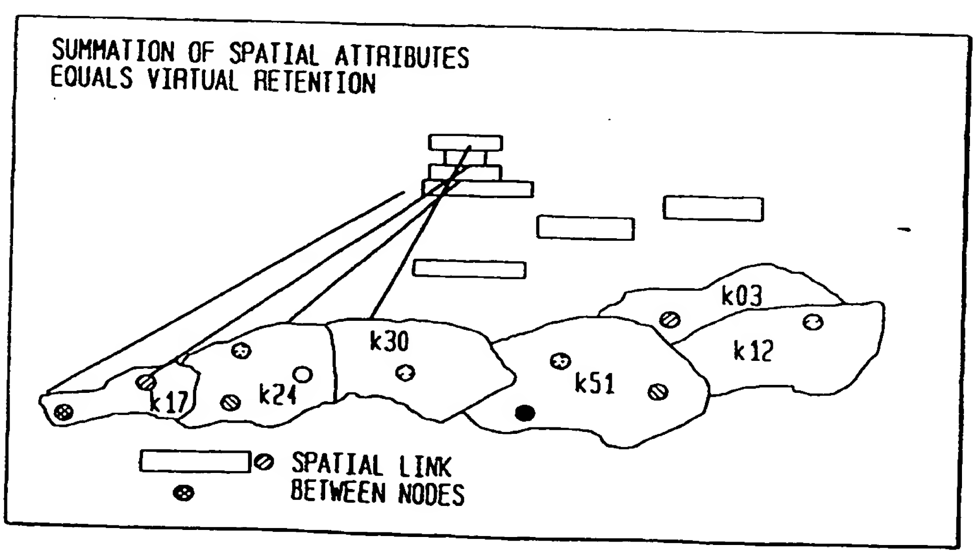


FIG. 18C



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/21363

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G06F 17/60
US CL :705/4
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 705/4

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, Dialog

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,975,840 A (DETORE et al.) 04 December 1990, entire document.	1-5,7-11,13-17,19-21
Y	US 4,837,693 A (SCHOTZ) 06 June 1989, entire document.	1-7,9-13,15-19,21
Y	US 4,831,526 A (LUCHS et al.) 16 May 1989, entire document.	1-5,8-11,14-17,20,21
Y	US 4,752,877 A (ROBERTS et al.) 21 June 1988, entire document.	1-6,9-12,15-18,21

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
01 FEBRUARY 1998	09 MAR 1998

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Gail O. Hayes
Facsimile No. (703) 305-3230	Telephone No. (703) 305-9711